

# Mir 23 to begin repairs of key station systems

American Jerry Linenger and his Mir 23 crew mates were expected to begin repairing key equipment aboard the Russian Mir Space Station following the planned Tuesday docking of a Progress resupply ship.

Linenger, Commander Vasily Tsibliev and Flight Engineer Alexander Lazutkin will work on one of Mir's oxygen generating units and a cooling loop leak which caused the shutdown of a carbon dioxide scrubbing machine.

Late last week, Russian flight controllers detected a leak in one of the Kvant-2 module's thermal loops. This loop provides a similar cooling function for the Kvant-2 module as does the so-called KOB loop for the Mir's core module, maintaining structural temperature.

On April 2, the crew began repair of the loop by using sealant and a waterproof cloth. To compensate for the temporary loss of this loop, the Mir station's orientation was altered so the Kvant-2 module was shadowed from

the Sun by the Kvant-1 module, the core module and the station's solar arrays.

Previously, another cooling loop in the Kvant-1 module experienced a decrease in pressure across one of its pumps. This pump was switched off and another turned on to stabilize the pressure. But the pressure dropped again, resulting in a shutdown of a carbon dioxide scrubbing system known as Vozdukh. With the Vozdukh shut down, carbon dioxide removal is being performed by lithium hydroxide canisters. This is expected to continue until the Kvant-2 cooling loop is operational.

The trio continued to generate oxygen by burning solid-fuel oxygen generators known as "candles." The crew has burned three "candles" each day to maintain acceptable oxygen levels aboard the station.

The Progress, launched Sunday, is carrying repair equipment for the Mir's Elektron oxygen-generating system and additional candles, lithium hydroxide canisters, extra repair gear for the station's cooling loops as well as routine supplies of food, equipment and personal effects for the crew. New space-suits for a planned space walk by Tsibliev and Linenger on April 29 are also stored aboard. The Progress was scheduled to dock to Mir at 12:28 p.m. CDT Tuesday, April 8.

Meanwhile, Linenger became the fourth most experienced astronaut.

Linenger's total time in space includes his shuttle flight on the STS-64 mission and puts him behind Shannon Lucid, John Blaha and Norm Thagard — all preceding him as crew members aboard Mir — as the most experienced space travelers in U.S.



history. His total flight time surpassed that of the American Skylab 4 crew of 84 days in space. Linenger will surpass the single mission records of Thagard on May 6 and Blaha on May 20 before he returns home aboard *Atlantis* in May. He will be replaced on Mir by Mike Foale who returned to JSC this week for training prior to the May 15 launch.

In an interview this month with CNN, Linenger said he has seen some incredible natural wonders in space and is very busy.

"I have seen a comet up here that is absolutely spectacular," Linenger said. "There is so many natural wonders out here that it is mind boggling. It's very, very busy and very exacting work that I have to do. The most difficult thing is being constantly vigilant of what I am doing, working very methodically and using every once of brain cell that I have to try to perform these very important experiments and repair the station."

## External tank completes pressure tests

The first new, super lightweight, external fuel tank for the space shuttle is set for final assembly after successfully completing proof pressure tests that verify its design.

The achievement is a significant step toward the first launch of the International Space Station. The new external tank is the same size as the one currently used on the space shuttle—but about 7,500 pounds lighter.

"Each pound we remove from the external tank is a pound that can be added to the payload," said Parker Counts, manager of the External Tank Project at NASA's Marshall Space Flight Center. "The lighter tank is essential for launching the space station because the station components will be assembled in a more demanding orbit than previously planned."

The 154-foot-long external tank, higher than a 15-story building and as wide as a silo with a diameter of about 27 feet, is the largest single component of the space shuttle.

The two major changes to the external tank involve materials and design. Both the liquid hydrogen and the liquid oxygen tank are constructed of aluminum lithium—a lighter, stronger material than the metal alloy used for the space shuttle's current external tank. The tank's structural design also has been improved. The walls of the redesigned hydrogen tank are manufactured in an orthogonal waffle-like pattern, providing more strength and stability than the previous design.

"The new external tank has passed one of the most innovative structural verification test programs ever designed, culminating with these proof tests," Counts said.

The proof test for the liquid oxygen tank was a hydrostatic, or water pressure test. The tank was placed vertically on the test stand at NASA's Michoud Assembly Facility in New Orleans, and filled with water, which has similar density to liquid oxygen. The tests simulated conditions encountered during flights and validated the design changes.

The liquid hydrogen tank was pressurized with gaseous nitrogen and subjected to conditions simulating the thrust of the orbiter's main engines and solid rocket boosters. Tests checked the new design by exposing the tank to harsher conditions than it will encounter in flight.

After the tests, comprehensive X-ray and dye inspections will be performed to further verify the tank's flight worthiness. The proof tests completed March 25 were the final in a series of rigorous certification and structural verification tests.

After thermal protection foam is sprayed on its exterior, the first super lightweight tank will be shipped by barge from Louisiana to the Kennedy Space Center, for its launch with the first elements of the International Space Station. The changes to the external tank will not affect the assembly process when the orbiter is mated to its tank and solid rocket boosters.



NASA Photo

**HATCH CHECK—Astronaut Jim Newman prepares to open a hatch that was built for the International Space Station. Newman and fellow astronaut Bob Cabana participated in hatch qualification and life-cycle testing which is under way at NASA's Marshall Space Flight Center. The two astronauts are members of the STS-88 space shuttle crew in which the shuttle will carry the first U.S.-built space station element, Node 1, into space for assembly. As station elements are joined together, this and similar hatches will provide a common link or doorway between modules of the station. The modules are being built by Boeing Defense and Space Group in Huntsville, Ala.**

## Endeavour returns to fleet at KSC ahead of schedule

*Endeavour* rejoined the shuttle fleet last month with increased payload carrying capability and key new features to support the assembly of the International Space Station.

Following an ambitious eight-month structural inspection and major modification effort, *Endeavour* rolled out of the Boeing North American Orbiter Major Modification Center ahead of schedule. Upon its arrival at KSC, United Space Alliance ground crews begin processing operations to prepare *Endeavour* for its next mission, scheduled for December.

The Boeing North American team, which conducts major orbiter modifications under contract with USA, removed and reinstalled more than 2,000 parts including the replacement of the internal airlock with a new external airlock designed to accommodate space walks and docking with the space station. In addition, provisions for a new

assembly power converter unit were installed to make the orbiter electrically compatible with space station voltage levels.

A number of modifications also contributed weight savings including changes to the payload bay doors and replacement of 860 thermal protection system blankets with 165 new lightweight blankets. The overall reduction in weight of more than a ton translates to improved performance needed to get the shuttle to

the higher altitude and orbital inclination required for station assembly.

The effort marked the second use of the Palmdale, Calif., facility's new vehicle automated checkout system which replaced the previous system used since 1970. The new system has played a major role in improving the speed and efficiency of the two most recent vehicle checkouts. The next orbiter due for major modification work is *Atlantis*, currently scheduled to begin later this year.

## Internet News: NASA centers cooperate to put STS-83 on-line

Need to find some interesting details on the STS-83 Microgravity Science Laboratory-1 mission? The Internet is the place to go, with NASA centers around the country providing a wealth of information about the flight, its crew and its experiments.

The first stop is the NASA Shuttle Web, which provides an overview of the activities on board with daily updates, real-time telemetry and background information that ranges from the official press kit to crew menus.

Anyone who has had difficulty accessing the NASA Shuttle Web on past missions because of heavy traffic should try again this flight, because STS-83 marks the maiden flight for the Internet Maintenance and Operations Contract. IMOC is a pathfinding effort by JSC's Information Services Directorate to outsource the maintenance and operation of the servers holding the data and the Internet connectivity that takes people there. The NASAwide



site, which is managed by JSC for the agency, is the first major public Web site to be handled under such an arrangement.

The new contract, which provides the vendor with incentives to increase the speed and accessibility of the server and the connectivity bandwidth (the size of the pipe through which the information flows), is expected to vastly improve response times and allow more people to access the information simultaneously.

From the main NASA Shuttle Web page at <http://shuttle.nasa.gov>, visitors will be able to visit the four major sections on Countdown, Launch, Orbit and Landing activities.

Also available are overviews of the mission, the astronauts and the payloads. All of the NASA Shuttle Web's standard features will be available, including the latest electronic images, lists of sighting opportunities, orbital elements for those who like to track the position of the shuttle on their home computers, and opportunities to ask questions of the crew and flight controllers.

Several other NASA sites are providing additional details about the scientific research being tackled on this flight.

The Payload Operations Control Center offers detailed information about each of the experiments flying on MSL-1 at: <http://liftoff.msfc.nasa.gov/spacelab/msl/welcome.html>

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The Space Science Laboratory at Marshall also has put together a set of Web pages that answer the questions of why scientists want to study things in microgravity, how they are going about it and who is involved. You can even visit a ground cyber-laboratory and perform some mock experiments. It's at: <http://www.ssl.msfc.nasa.gov/msl1/msl1hframe.htm>

As NASA's lead center for microgravity fluids and combustion research, Lewis Research Center has details on the new Combustion Module-1 rack at: <http://zeta.lerc.nasa.gov/msl1/overview.htm>

Ames Research Center has information about STS-83 studies of plants that may someday lead to the production of life-saving medicines and other important compounds at: [http://ccf.arc.nasa.gov/dx/basket/storieset/97\\_22AR.html](http://ccf.arc.nasa.gov/dx/basket/storieset/97_22AR.html)

Finally, Langley Research Center offers the on-line version of the quarterly Microgravity News publication at: <http://mgmwww.larc.nasa.gov/>